Overview of Postharvest Integrated Pest Management

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Agricultural production and food distribution systems have evolved over many years to a complex system which allows for nearly year-round supply of most fresh commodities through long-term storage and long-distance shipments to consumers. The expectation of year-round supplies has resulted in increased challenges for postharvest handling systems. The availability of fungicides for disease management likely played a major role in the evolution of our current system of food distribution. With the recent loss of registration of many pre- and postharvest fungicides and more expected under the Food Quality Protection Act (FQPA), as well as consumer pressure to reduce the amount of chemicals used on food, the challenge to maintain our current system of food distribution increases. The fresh produce industry must begin to place increased emphasis on other methods of pest management.

As with integrated pest management in agricultural production, postharvest IPM is a system approach towards pest management where good management practices are combined with one or more contributory treatments to result in an acceptable level of disease and insect control. A successful IPM system requires a higher degree of involvement with the postharvest handling process including close observation and attention to details. Decisions on pest management strategies are made as a result of those observations.

IPM Begins in the Field

Postharvest IPM begins in the field with selection of the varieties to be grown. For most crops produced, there are differences in resistance to diseases and insects among the available varieties. Differences may be due to the presence of natural defense mechanisms within the commodity or morphological differences (i.e., cuticle thickness) which provide differing degrees of resistance. Selection of the most resistant variety can reduce the need for other pest control measures.

In addition to the natural resistance of the commodity, cultural practices can have a great effect on the commodity's susceptibility to diseases and insects. Nitrogen fertilization, irrigation and calcium nutrition are some of the most important preharvest factors for pest susceptibility. Heavy nitrogen fertilization, heavy irrigation and low calcium nutrition can result in a product which has greater susceptibility to decay.

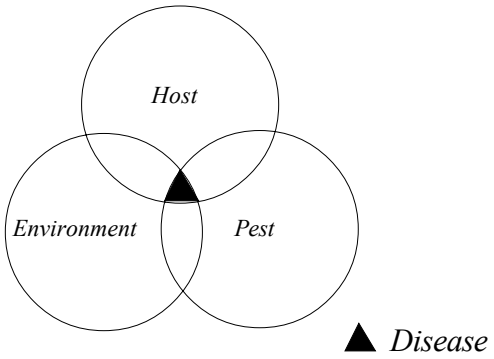
Field Handling and Sanitation

At harvest, the maturity of the commodity and its stage of development or ripeness can greatly influence susceptibility to pests. From harvest to consumption, care in handling of produce is very important. The natural skin of the commodity provides the best protection against postharvest diseases. Most postharvest pathogens cannot attack the product without the presence of a wound. Every step should be taken to reduce injury to the commodity (see Effect of Preharvest Factors and Bruising in Stone Fruit Decay). Also, sanitation, both in the field and during postharvest handling, can reduce the potential for infection to occur (see Postharvest Uses of Ozone on Fresh Fruit). Prediction tools are being developed to allow growers and packers to determine the disease pressure in a given orchard's fruit and tailor the disease control strategies in response to that pressure or lack thereof.

Temperature Management
After harvest, the most important management tool is temperature. Maintaining the product at the lowest temperature tolerated by the product reduces the growth of decay organisms, slows the activity or ingress of insects and maintains the product in a healthy condition. Low temperatures reduce the rate of fruit ripening and senescence both of which result in increased susceptibility to pests.

Physical Treatment
Careful attention to and management of these factors can significantly reduce decay potential, but may not provide complete control. There are a range of physical treatments which can contribute further to pest management including heat treatments, biological control and controlled atmospheres (see Do High Oxygen Atmospheres Control Postharvest Decay on Fruits and Vegetables?). UV illumination has been demonstrated to increase the natural resistance of some commodities, and has been studied as a direct method for decay control (see Comparing Pulsated Ultraviolet Light and Postharvest Fungicide for Peach Fruit Decay Control). Radiation of fresh fruits and vegetables has been approved since 1989 at the 1 kGray dose. Irradiation shows promise as an insect control treatment for a number of commodities (see Irradiation as a Quarantine Treatment), but its benefits for decay control are limited.

The ability of the pest to infest the host depends on the effectiveness of its mechanisms of invasion. In many ways, the pest is dependent on the host's susceptibility and environmental factors. The development of a pest infestation depends on favorable conditions in the environment, the host and the pest. By manipulation of one of these three factors, we can reduce the level of pest problems. As we have discussed, the host's suitability for pest infestation can depend on natural resistance, cultural practices, or the presence of wounds. The environment can be manipulated easily after harvest to provide a temperature or an atmosphere that is unfavorable to pests and favorable to the host.



Postharvest fungicides and growth regulators will continue to be important tools for managing postharvest decay and maintaining product quality.

Individually, none of the methods discussed herein would likely provide adequate pest management. However, combining several of these factors together can provide for effective pest management and improved postharvest quality of horticultural perishables.